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Observation of intrinsic Magnus force and direct detection of chirality in superfluid3He-A

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Abstract

©2015 The Physical Society of Japan. We report details of the observation of the intrinsic Magnus (IM) force acting on negative and positive ions trapped just below a free surface of the A phase of super fluid 3He (3He-A). From the transport measurements of the ions along the surface, we found that the IM force acts on both the negative and positive ions. We also demonstrate that the transport measurements could distinguish whether the surface is composed of a chiral monodomain or multiple chiral domains. For multiple chiral domains, the current of the ions was found to be irreproducible and unstable, which was reasonably explained by the formation of the chiral domain structure and the dynamics of the chiral domain walls. For chiral monodomains, the appearance ratio of chirality emerging upon cooling through the superfluid transition temperature was found to depend on the direction of the external magnetic field, which implies the existence of an unknown coupling between the chirality and the magnetic field.

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